CONSERVATION TILLAGE

FACTS

Optimum Wheat Stubble Height to Reduce Erosion and Evaporation

Your stubble height can affect soil erosion and evaporation from the soil surface

How high should I set my cutter bar when I harvest my wheat? The answer to that question may depend upon your objective. If you want to be sure to harvest every head possible, you could run the sickle on the ground. But if your objective has something to do with good residue management and the protection residue offers the soil from wind erosion while reducing evaporation from the soil surface, then a higher cutting height maybe better for you.

A rule of thumb followed by many Great Plains wheat growers is to cut wheat at 2/3 of the plant height (16 in. cutting height on 24 in. tall wheat). This rule fits observations of the distributions of head heights seen in the field, where a cutting height of 2/3 of the plant height would harvest 99% of the heads. But does this height of stubble provide adequate protection to the soil surface against wind erosion and reduce evaporation so that precipitation storage during the fallow period is maximized?

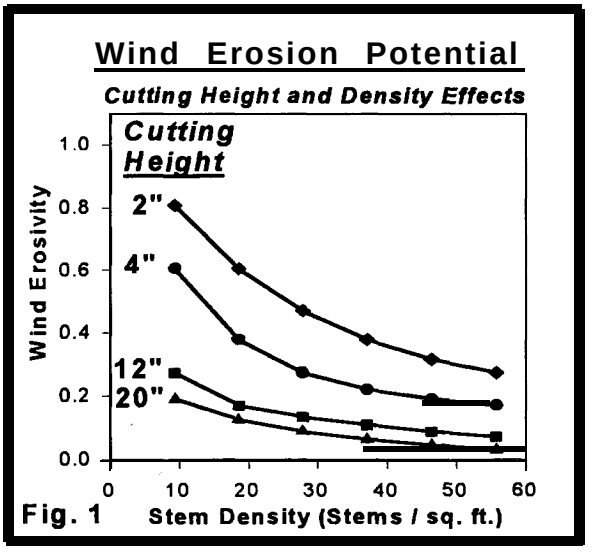

Fig. 1

Erosion Protection

Increasing stem height and stem density (number of stems per square foot) reduces the wind speed near the soil surface. Erosivity (0 = no erosion, 1 = erosion rate from bare soil surface) decreases as winds are slowed by taller stubble or higher stem density (Fig. 1). Stem density is the number of stems in a foot of row times the row spacing (in feet). For example, 80 stems in a foot of row with a row spacing of 9 inches (O. 75ft.) equals a stem density of 60 stems/ft^2. Stem densities vary widely from year to year, depending on tillering and seeding rate, but generally range from 20 to 70 stems/ft^2. A low cutting height of 4 in. provides little protection when stubble is sparse (9 stems/ft^2). Higher cutting heights of 12 in. or 20 in. increase soil protection (reduce erosivity). Little additional protection against erosion is gained for stems taller than 12 in. when stem density is greater than 25 stems/ft^2.

Reducing Evaporation

As standing wheat stubble slows the wind near the soil surface and shades the soil surface,

Conservation Tillage Fact Sheet #4-97. Published by USDA-ARS, NRCS, and Colorado Conservation Tillage Association.
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evaporation rate declines (Fig. 2). The relative evaporation rate (0 = no evaporation, 1 = evaporation from a wet, bare soil surface) declines as stem height and stem density increase. A low cutting height of 4 in. provides little protection against evaporation for sparse stands. Increasing the stubble height of dense stands (greater than 25 stems/ft^2) from 12 in. to 20 in. does little to reduce evaporation further.

Optimum Wheat Cutting Height

How do the three objectives of choosing a cutting height to minimize harvest losses, erosivity, and relative evaporation fit together? Figure 3 shows lines depicting the stem height and densities where 80% of the maximum benefits for soil and water conservation occur. For example. with a stem density of 37 stems/ft^2, a cutting height of only 6 in. is needed to obtain 80% of the maximum erosion protection, compared with a 12 in. cutting height needed to obtain 80% of the maximum evaporation protection. Cutting wheat to a height that minimizes evaporation will automatically minimize erosivity. For both erosion protection and evaporation reduction, stem density and height can substitute for each other (i.e., a tall, low density stand can provide the same protection as a short, high density stand.)

A stripper header for a combine does not cut wheat stems at harvest. Closely spaced fingers on a fast-moving reel remove the heads from the stems, leaving the stems as tall as possible. For a stem density less than 25 stems/ft^2, it is not possible to obtain 80% of the maximum water conservation benefits, regardless of how tall the stems are. Therefore, leaving the stubble as tall as possible through the use of a stripper header would reduce the evaporation potential as much as possible.

Figure 3 shows the typical maximum height that both traditional height and semidwarf wheat varieties can be cut and still minimize yield loss caused by missed heads. Cutting wheat in this range of heights (15 to 22 in.) would achieve the goals of minimizing harvest losses, erosivity, and relative evaporation. Stubble height in this range is very effective in trapping snow and increasing overwinter soil water contents, although stubble taller than 18 in. may be more likely to be flattened under some winter storm conditions. The additional soil water stored through snow catch and reduced evaporation from tall stubble has a value of about 7.5 bu/a of wheat for every inch of additional water stored in the soil profile.

Standing residues are 5 to 7 times more effective than flat residues in controlling wind erosion. Therefore, producers should keep implement, truck, and livestock traffic to a minimum, concentrating necessary traffic in areas with lowest soil erodibility. Careful management of wheat cutting height can reduce erosion and evaporation while optimizing yield.

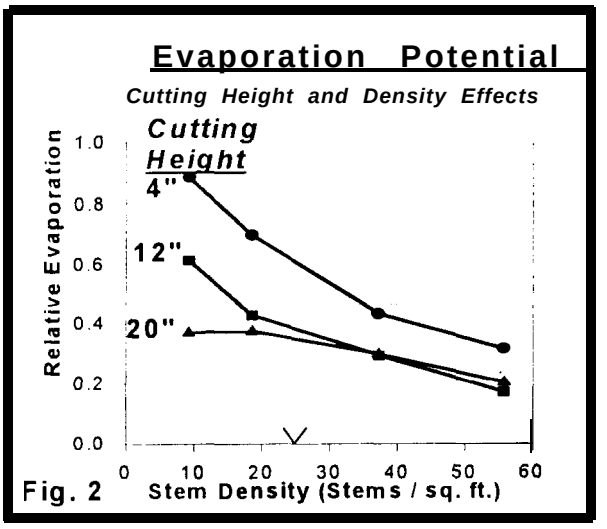

Fig. 2

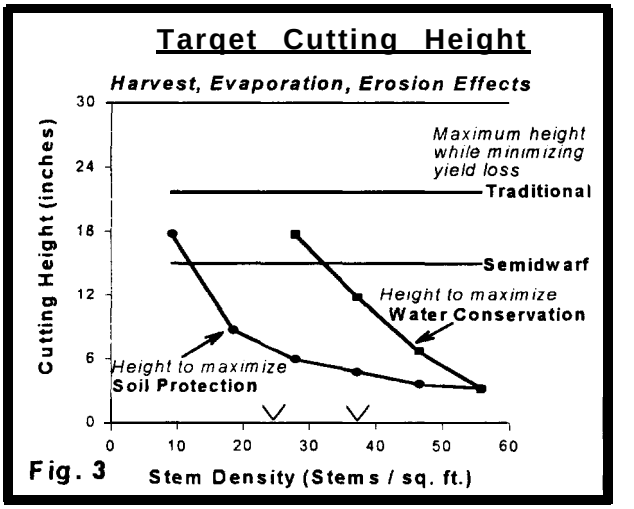

Fig. 3